

Claims

What is claimed is:

- 5 1. Apparatus for the purification of a substance from a solution, a suspension or a mixture of liquids by crystallization, preferably in a continuous manner, comprising:
 - a. first crystallizer (1c) comprising an input (1) for receiving a liquid comprising the substance and an output (4) for discharging a slurry of liquid and crystals,
 - 10 b. a first separator (1s) connected to the output 4 of the first crystallizer (1c) having a product output (2), and being with a residue output (5) connected to an input of a second crystallizer (2c),
 - c. a second separator (2s) being with an input connected to an output (6) of the second crystallizer (2c), a crystal output (7) of the second separator (2s) being connected to an input of the first crystallizer (1c).
2. The apparatus according to claim 1, wherein at least one of the separators (1s, 2s) comprises a wash column.
- 20 3. The apparatus according to claim 2, wherein the second separator (2s) comprises a wash column and preferably a piston type wash column.
4. The apparatus according to any of the preceding claims including a filter or a settling zone for the crystals in at least one of the crystallizers
- 25 5. The apparatus according to any of the preceding claims wherein the output of the second separator (2s) comprises a heating means (10).
- 30 6. The apparatus according to any of the preceding claims wherein the crystals separated in the second separator (2s) are being combined with a slurry stream from the first crystallizer before being input into the first crystallizer via duct (11).

7. The apparatus according to any of the preceding claims where the crystals separated in the second separator (2s) being combined with at least part of the feed (1) via duct (12) before being input into the first crystallizer (1c).
- 5 8. The apparatus according to any of the preceding claims wherein the crystals separated in the second separator (2s) being combined with at least part of the liquid output (5) via a duct (13) before input into the first crystallizer (1c).
9. A method for the purification of a substance from a solution, a suspension or a mixture of liquids by crystallization, preferably in a continuous manner, comprising the steps of:
 - a. feeding a liquid comprising the substance to a first crystallizer (1c) and forming crystals in said first crystallizer,
 - b. feeding a slurry comprising crystals from the first crystallizer (1c) to a first separator (1s), characterized in that
 - 15 c. the crystals are separated from the liquid residue, and more preferably melted and discharged as liquid product,
 - d. a portion of the liquid residue from the separator (1s) is transported to a second crystallizer (2c) and crystals are formed in said second crystallizer (2c),
 - e. feeding a slurry comprising crystals from the second crystallizer (2c) to a second separator (2s), wherein,
 - f. the crystals are separated removing at least a portion, preferably a major portion of the liquid residue in the second separator (2s) and the crystals are transported back from the second separator (2s) to the first crystallizer (1c), and
 - 25 g. at least a portion of the liquid residue is discharged.
10. Method according to claim 9 wherein the crystals from the second separator (2s) are partially melted prior to being transported back to the first crystallizer.

11. Method according to claim 9 or 10, wherein the crystals from the second separator (2s) are mixed with a part of the slurry from the first crystallizer (1c) prior to being transported back to the first crystallizer.
- 5 12. Method according to claim 9, 10 or 11, wherein the crystals from the second separator (2s) are mixed with a part of the feed prior to being transported back to the first crystallizer (1c).
- 10 13. Method according to any of the preceding, wherein the crystals from the second separator (2s) are mixed with a part of the liquid residue from the first separator (1s) prior to being transported back to the first crystallizer.
- 15 14. Method according to any of claims 9-13, wherein the temperature difference between the slurry from the first crystallizer and the melting point of the pure product is between 2 and 20 °C and preferably between 5 and 15 °C.
- 15 15. Method according to any of claims 9-14, wherein the temperature difference between the slurry from the first crystallizer and the slurry of the second crystallizer is between 25 and 75 °C.
- 20 16. Method according to any of claims 9-15, wherein a portion of the liquid residue from at least one crystallizer is withdrawn via a separate filter unit instead of the separator.
- 25 17. Method according to any of the preceding claims, characterized in that the ratio of the crystal production in the second step relative to the total crystal production is between 5 and 50% and preferably between 10 and 25%.